

# Chapter 11

## Metal Fumes – Welding/Cutting

### 1.1 Purpose/Scope

- To measure airborne concentrations of particulates generated from welding and cutting operations.

### 1.2 Definition

- A fume is an airborne particle formed when a metal, which is solid at room temperature, is melted, vaporizes into the atmosphere, and then condenses to a solid again.

### 1.3 Evaluating the Hazard

#### A) Breathing Zone Samples

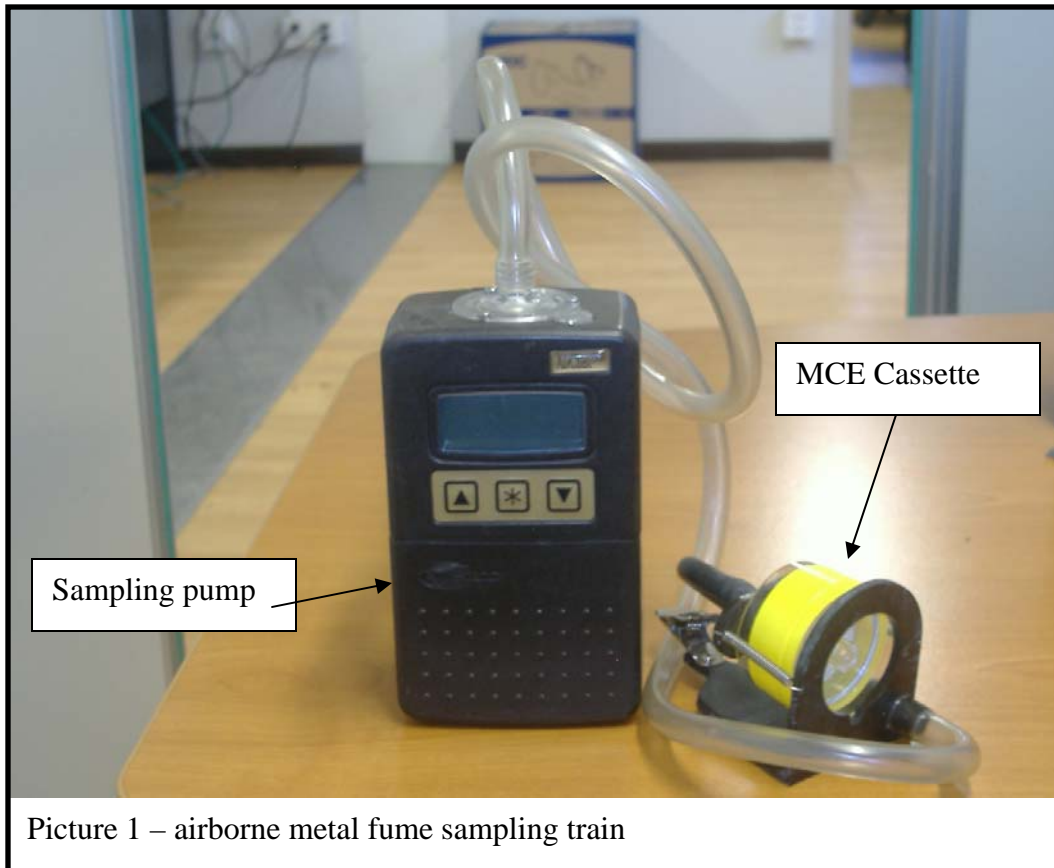
- All personal samples shall be taken in the worker's breathing zone. The breathing zone of a welder wearing a welding hood is considered to be under the hood when the face shield is in the down position.

#### B) Short-Term Samples

- When welding work is done for less than a full shift, short term sampling is appropriate. Short-term samples are also taken when high exposures to ceiling limit contaminants (i.e. manganese and cadmium) are anticipated. All short-term sampling should be taken for at least 15 minutes to allow enough contaminant to be collected for analysis. (Consult the certified lab used, for analysis requirements.) Collect at least one short-term sample during a period of suspected peak exposure.

#### C) Full-Shift Samples

- Full-shift sampling should be used when employees will be welding or exposed to fume sources for all or most of their work shift. If full shift sampling is interrupted to take short-term sampling, the contaminant amounts determined by analysis of the full-shift and each short-term sample must be added to obtain the full-shift exposure for each contaminant.



## 1.4 Sampling Equipment

- A) Battery operated vacuum pumps
- B) Two-piece filter cassette, 37mm diameter
  - Metal Scan: Mixed cellulose ester (MCE) membrane filter with 0.8 micron pore size for monitoring for individual metals; analysis by inductively coupled argon plasma spectroscopy.
  - Hexavalent Chromium (Chromium VI) Metal Fumes: Untared PVC filter with 5.0 micron pore size for monitoring only hexavalent chromium (does not include other forms of chromium nor can other metals be determined on the same filter); analysis by colorimetry.
- C) Standard Flow Meter Calibrator
- D) Sampling Hose

## 1.5 Sampling Procedures

**A) Prepare and Calibrate Pump - Refer to Calibration Procedures Chapter**

- a. Assemble the sampling train consisting of the sampling hose and pump.
- b. Use a filter cassette of the same type used for sampling and attach to sampling train and calibrator.
- c. Calibrate per manufacture recommendations for a flow rate of 2.0 L/min. Document starting calibration flow rate.

**B) Select Worker**

- a. Select a worker to be sampled and inform the worker what you are doing, what the sampling device does, and the reason for the sampling.
- b. Instruct the worker not to remove the sampler for any reason and not to cover the filter cassette with a coat or other garment.
- c. Emphasize the need for the worker to continue to work in a routine manner, and to inform you of any unusual occurrences during the sampling period.
- d. Inform the worker when and where the sampler will be removed.

**C) Attach Sampling Train to Worker**

- a. Attach the pump to the worker's belt
- b. Position the pump so it does not interfere with the worker's activities.
- c. Attach the sampling head assembly to the clothing or the welder's hood.
  1. Ensure that the inlet of the filter cassette is facing down and next to the cheek.
  2. Check to make sure there is enough slack in the sampling hose and that the cassette will be under the hood when the hood is in the down position. (This is the welder's actual breathing zone and will give a true representative sample of the worker's exposure.)

#### D) Collect Sample

- a. Remove the plug from the cassette inlet.
- b. Start the pump and record the start time.
- c. Check the pump and sampling train as frequently as practical. Record all pertinent information in your field notes.
- d. Record activity of the worker and equipment operating in the area. Note controls in use and potential sources of exposure.

#### E) Remove Sampling Train from Worker

- a. Be at the location specified at the start of the sampling period for the collection of the sampling train.
- b. Turn the pump off and record the end time.
- c. Remove the filter cassette from the sampling train and replace the plugs in the inlet and outlet openings of the cassette. Handle the cassette carefully to avoid losing sample and make sure cassette is properly labeled.

#### F) Post-Sampling

- a. Make sure filter cassette is properly labeled and can be cross referenced to your field notes.
- b. Complete a post-calibration per manufacture recommendations with a representative filter in line to verify that the flow has not changed plus or minus 5%. Document the post-calibration flow rate. Use the average of the initial and final flow rate to calculate total volume sample.
- c. Along with the sample filter cassette, submit a blank from the same lot number as the sample filter cassette. This is done so that any contamination from handling samples will be accounted for in the final analysis.
- d. Fill out the required lab form and pack the sample filter, the blank, and all pertinent sampling information securely for shipment to a certified lab for analysis.